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ABSTRACT

The collection of observational data in natural settings and in real time requires equipment that is light and easily used, and programs that permit rapid and flexible encoding of data. This paper describes a set of four programs for collecting and analyzing continuous time sample, focal-individual data as described by J. Altmann (1974), using a lightweight lap-top computer, the Toshiba T-1000. The programs are: (1) FOCAL, the data entry program; (2) SCAN, which adds the number of events and trials, total time observed, and number of days during which data were collected; (3) KAPPA, which assesses reliabilities for single codes and codes combined into new categories; and (4) LAG, for sequential analyses. The programs can be used on any IBM-compatible machine and can generate reliabilities (percent agreement and kappa), rates, frequencies, and conditional probabilities with their "z"-scores for the data. The data and report files created by these programs are DOS text files. Five figures provide sample outputs from the four programs. (SLD)

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Programs for the field collection of observational data

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Abstract

The collection of observational data in natural settings and in real time requires equipment that is light and easily used, and programs that permit rapid and flexible encoding of data. This paper describes a set of four programs for collecting and analyzing continuous time sample, focal-individual data (Altmann, 1974), using a lightweight laptop computer, the Toshiba T-1000. They can be used on any IBM-compatible machine. From these data, reliabilities (per cent agreement and kappa), rates, frequencies, and conditional probabilities with their *z*-scores can be generated. These programs, developed under funding from the Social Sciences and Humanities Research Council of Canada, are available without charge for purposes of research and teaching.

Programs for the field collection of observational data

This paper describes a set of four programs (FOCAL, SCAN, KAPPA, and LAG) for collecting and analyzing continuous time sample, focal-individual data (Altmann, 1974), using a lightweight laptop computer, the Toshiba T-1000. They can be used on any IBM-compatible machine. From these data, reliabilities (per cent agreement and kappa), rates, frequencies, and conditional probabilities with their z-scores can be generated. The data and report files created by these programs are DOS Text files, allowing them to be read and manipulated by commonly used word processing and statistical programs, such as Word Perfect and BMDP.

Because these programs were developed for research funded by the Social Sciences and Humanities Research Council of Canada (Strategic Grant No. 498-87-0026 to William Roberts), they are available without charge for purposes of research and teaching. Copies (including full documentation on disk) can be obtained by sending a blank, formatted diskette to the senior author.

FOCAL

FOCAL, the data-entry program, is designed to collect sequential observational data, coded continuously in real time, using focal individual samples and exhaustive, mutually exclusive behavior codes (see Altmann, 1974; Bakeman and Gottman, 1986). It does not support the coding of simultaneous behaviors.

Observations are entered in "initiator-action-target"

format, using user-specified numerical codes. (The target's response, if desired, can be entered in the following 'sentence'.) FOCAL records duration automatically. Cumulative duration is reported on the data entry screen (see below), so that the length of focal samples can be user controlled.

Numeric codes are used for the sake of speed, important when coding in real time. Because FOCAL treats the right half of the keyboard as a numeric keypad during data collection, numeric codes can be entered rapidly with one hand, leaving the other hand free to support the computer. (Such an arrangement is not possible using alphabetic codes.) In this way, data can be entered as the observer walks from place to place, freeing subjects to move about as they normally would.

As shown in the example in Figure 1, FOCAL displays 'prompt screens' showing codes for behaviors and persons. FOCAL will handle taxonomies as large as 99 categories. Codes for behaviors and persons are specified by the user in DOS Text files, easily created and edited by most word processors. In addition, new members can be added to the "person list" at the beginning of each observation session. FOCAL appends new persons to the current list and assigns them a number (up to a limit of 99); this list is then saved in a DOS Text file and used by FOCAL in future sessions, so that names only need be entered once. These files (one is created for each case) also serve as permanent records of the names and codes used for each participant.

During data collection, both person and behavior codes are

checked as they are entered; codes that are not on the user-supplied lists result in a warning bell, and the observer is prompted for correct codes.

Insert Figure 1 about here

Errors in the current line can be corrected immediately; errors in earlier lines can be flagged for later correction, so that on-going behavior can continue to be coded. (The previous dozen data 'sentences' as well as the one being currently entered are displayed.) It is possible to make corrections immediately following a focal sample, if desired: FOCAL allows users to make a temporary exit to DOS, where data files can be edited using any word processor.

The data collection screen also displays the current focal person, the trial number, and the date and time, as well as the cumulative duration of the current focal sample. This information (along with the observer's name) is also written into the permanent data file that the program creates, as shown in the example in Figure 2.

Insert Figure 2 about here

SCAN

After collection and correction, FOCAL data files can be read by SCAN, which sums, for each case, the number of events and

trials, total time observed, and number of days on which data were collected. SCAN also confirms that error flags have been removed. An example is shown in Figure 3.

Insert Figure 3 about here

KAPPA

Using KAPPA, reliabilities can be assessed for single codes and for codes combined into new categories. In addition to calculating kappa and per cent agreement for the codes as a set, per cent agreement is also reported for each individual code. As well, KAPPA also reports the four codes most frequently confused with each code.

Codes can be grouped or re-coded into new, more molar, categories. Re-coding does not alter the original data file; rather, KAPPA combines codes during its analyses.

Because observers coding in real time will necessarily be slightly out of synchrony even when they agree about which codes to use, KAPPA allows the user to specify how much temporal discrepancy to tolerate. Relatively generous tolerances indicate per cent agreement when sequential information only is of importance. More stringent tolerances indicate per cent agreement when temporal pacing is important, as it is for rates and time-budget variables. How much asynchrony should be tolerated is unclear, and probably varies depending on the behaviors being coded and the research questions of interest. The default

tolerance is 5 seconds.

KAPPA matches events using cumulative time to guide it. (As shown in Figure 1, this is the last value in each data line generated by FOCAL.) If cumulative time is the same for both coders (within the tolerance specified), the program moves to the next event for each coder. If one coder is behind the other, the program moves to that coder's next event. This is repeated until the cumulative times are equal (or the first coder is ahead of the second, in which case the roles are reversed).

An example of output from KAPPA is displayed in Figure 4.

Insert Figure 4 about here

LAG

Sequential analyses can be carried out using LAG. After the user specifies a criterion actor-action-target sequence and the 'lag' of interest (the first, second, etc., event to follow the criterion), conditional probabilities and their z-scores (Bakeman & Gottman, 1986) are calculated. Bakeman and Gottman's rule of thumb[2] is used to assess whether enough events have been sampled in order for z scores to be stable: violations are flagged in the output.

Frequencies and rates are also reported, based on the focal samples analyzed. For example, if both father and child have been

---

[2] T * p * (1-p) > 9, where T= total of all dyadic events and p= the conditional probability for the event of interest.

focal individuals, then the analysis of "child speaks to father" (coded "3 20 1" in Figures 1 and 2) is based on both child and father focal samples, as shown in the example of LAG output in Figure 5. However, the analysis of "child plays alone" (coded "3 04 3", in Figures 1 and 2) is based on child focal samples only, and reported frequencies and rates are based on those focal samples alone. Thus values for (and the validity of) rates and frequencies depend on the analysis specified.

LAG also reports the total duration of criterion events as a proportion of total time observed, thus providing 'time-budget' data of the type discussed by Altmann (1974).

Insert Figure 5 about here

Like KAPPA, LAG can recombine any number of behavior codes into new, more molar categories. The original data files are not altered.

Because one typically does a series of lag analyses, all options can be specified from the DOS prompt, allowing multiple analyses to be run from batch files. (If options are not specified at the DOS prompt, the user is presented with a short series of menus.) In addition, if individuals have been coded consistently across groups (for example, if mothers were always coded "1" across families, fathers "2", etc.,), so that the same actor-action-target criterion is valid for each group, individual data files can be combined into one large file and analyzed with

one set of commands; LAG will report results separately for each case.

As mentioned earlier, LAG output files are DOS Text files. Thus frequencies, rates, conditional probabilities, z-scores, and time-budget data can be imported and analyzed by other statistical programs, such as BMDP.

Technical support for all programs is available from the senior author.

References

Altmann, J. (1974). Observational study of behavior: sampling methods. Behaviour, 49, 227-267.

Bakeman, R., & Gottman, J. (1986). Observing interaction: an introduction to sequential analysis. Cambridge: The Cambridge University Press.

Figure 1. A sample data collection screen from FOCAL.

```
ID #: Home 30   Session 1    03 APR 1991 at 18:05  Trial  1,  Focal person= 3

Q: Quit (F10: Pause)                                  01 eats
E: Error flag                                         02 plays
S: Save to disk                                       03 reads
T: display Time                                       04 activity
Space: restart line                                   05 watches TV
                                                      07 bathes, cares for child
                                                      08 sleeps, in bed
                                    Total Time:       09 unoccupied
 3  20  1
 1  20  3                                :30          10 nonverbal attention bid
 3  20  1                                             11 proposes
 1  20  3                                             12 requests
 3  12  1                                             13 offers help, object
 1  20  3                                             14 approaches
 3  29  1                                             15 directs
 3  04  3
 1  15  3                                             19 praises
 3  _                                                 20 speaks
                                                      21 offers alternatives
READY TO GO.
                                                        <F1> for more codes.
                                                        <F6> for persons.
```

Figure 2. An example FOCAL data file.

```
Family  30, Home Session 1. 08 APR 1990 at 18:43   Trial  1,  Focal person= 3
3  20  1       5.1      5.1
1  20  3       1.3      6.4
3  20  1       1.5      8.0
1  20  3       2.0     10.0
3  12  1       2.0     12.0
1  20  3       4.0     16.0
3  29  1       1.0     17.0
3  04  3      11.0     28.0
1  15  3       1.9     29.9
3  50  1       1.3     31.3
   .           .        .
   .           .        .
   .           .        .      << data omitted >>
   .           .        .
3  04  3      14.1    595.7
1  15  3       1.5    597.2
3  23  1       3.4    600.6
3  51  1       1.4    601.9
 -1
Family  30, Home Session 1. 08 APR 1990 at 19:06   Trial  2,  Focal person= 2
2  04  2     600.2    600.2
 -1
Family  30, Home Session 1. 08 APR 1990 at 19:18   Trial  3,  Focal person= 3
3  01  3       7.9      7.9
3  22  9       1.6      9.6
9  27  3       1.3     10.8
   .           .        .
   .           .        .
   .           .        .
```

Figure 3. An example output screen from SCAN

```
This program counts trials and time for observational data files,
                and prints a report in file SCAN.RPT.


Now scanning file CLASS99.L at line  364
Finished.

In file CLASS99.L there are 5 trials over 51.5 minutes, across 1 day.

    354 events were scanned.
No data errors were found.


Do another? (Y/N): Y_
```

Figure 4. An example of output from the reliability program, KAPPA

Reliabilities: Per cent agreement and kappa
Wednesday, April 3, 1991 6:28 p.m.

Coder= Anne Data from file RELIABIL.AS collected on 16 MAY 1990
Coder= Lee-Anne Data from file RELIABIL.LAH collected on 16 MAY 1990

Reliabilities calculated over 70.6 minutes across 7 trials
Permitted error in timing: 5 seconds

Code	Agreements/ Comparisons	Proportion agreement	Most frequent disagreements: code (frequency), code (frequency)
02	23 / 25	.920	78 (1) 20 (1)
03	6 / 7	.857	20 (1)
04	78 / 86	.907	20 (6) 41 (1) 29 (1)
05	10 / 12	.833	22 (1) 04 (1)
09	1 / 1	1.000	
11	10 / 12	.833	26 (1) 23 (1)
12	5 / 7	.714	20 (2)
13	6 / 6	1.000	
14	8 / 10	.800	20 (1) 04 (1)
15	14 / 18	.778	50 (2) 23 (1) 20 (1)
19	3 / 3	1.000	
20	262 / 288	.910	04 (11) 78 (5) 11 (4) 14 (2)
21	1 / 1	1.000	
22	28 / 30	.933	03 (1) 04 (1)
23	3 / 8	.375	20 (3) 04 (2)
24	3 / 3	1.000	
25	1 / 1	1.000	
26	10 / 14	.714	20 (3) 15 (1)
27	7 / 9	.778	02 (1) 20 (1)
29	5 / 7	.714	20 (2)
41	4 / 4	1.000	
42	1 / 1	1.000	
46	1 / 1	1.000	
50	11 / 12	.917	04 (1)
78	14 / 15	.933	20 (1)

Total agreements / total comparisons= 515 / 581
Overall proportion of agreement: .886
Kappa= .843

Figure 5. An example of lag sequential output from LAG

Data read from file HOME.30
Thursday, April 11, 1991 7:45 p.m.

Frequencies and rates for case 30, using focal samples for persons 3 and 1.

CODES	N	RATE (N / min)	CODES	N	RATE (N / min)
1 13 3	5	.25	1 15 3	15	.75
1 19 3	1	.05	1 20 3	31	1.54
1 21 3	2	.10	1 22 3	4	.20
1 41 3	2	.10	1 42 3	5	.25
3 01 3	26	1.29	3 02 3	1	.05
3 04 0	1	.05	3 04 3	24	1.19
3 05 3	2	.10	3 10 9	1	.05
3 12 1	3	.15	3 13 4	1	.05
3 14 1	2	.10	3 20 1	37	1.84
3 20 4	11	.55	3 20 9	5	.25
3 22 0	2	.10	3 22 1	4	.20
3 22 4	3	.15	3 22 9	2	.10
3 23 1	5	.25	3 23 9	1	.05
3 26 1	2	.10	3 27 1	6	.30
3 29 1	1	.05	3 29 3	3	.15
3 41 1	1	.05	3 50 1	8	.40
3 51 1	4	.20	4 14 3	1	.05
4 20 3	9	.45	4 22 3	2	.10
4 23 3	1	.05	4 27 3	1	.05
9 15 3	1	.05	9 20 3	1	.05
9 22 3	2	.10	9 27 3	3	.15

Total Events= 242

(Figure continues)

Lag results for case 30, criterion 3 20 1 at lag 1.
Total pairs of observations= 240

Response	frequency	lag p	Z	p	Stability index	
1 15 3	1	.027	-1.09	.2758	6.3	<<See warning>>
1 19 3	1	.027	1.92	.0548	6.3	<<See warning>>
1 20 3	22	.595	7.47	.0000	57.9	
1 21 3	1	.027	1.06	.2902	6.3	<<See warning>>
1 22 3	3	.081	2.69	.0072	17.9	
1 42 3	1	.027	.09	.9251	6.3	<<See warning>>
3 01 3	5	.135	.22	.8245	28.0	
3 04 3	1	.027	-1.72	.0858	6.3	<<See warning>>
3 23 1	1	.027	.09	.9251	6.3	<<See warning>>
4 20 3	1	.027	-.51	.6090	6.3	<<See warning>>
	37					

Total time= 20.11 minutes across 2 trials
Proportion of criterion time / total time= .079

Warning!

Stability index scores less than 9 indicate that Z is based on too few observations to be stable, and should not be used.